

BASELINE ASSESSMENT

WESTERN SPACE AND MISSILE CENTER

INTRODUCTION

At the direction of the Office of Commercial Space Transportation (OCST), Research Triangle Institute (RTI) conducted a study of the Western Space and Missile Center (WSMC). The purpose of the study was to establish a baseline upon which OCST can assess whether or not a commercial launch proposal is safe. The following information is presented as a result of this effort:

A. GENERAL INFORMATION

1. History and Experience - Vandenberg Air Force Base (VAFB) is located 55 miles north of Santa Barbara, California on over 98,400 acres of land. It is situated on the California coast with unobstructed launch corridors to the south and west. Certain flight azimuths allow for direct polar orbit insertion of satellites without overflight of populated areas.

VAFB was chosen in 1956 as the first Air Force missile base. At that time, it was an abandoned Army artillery training ground called Camp Cooke. In December 1958, the first missile, a Thor Intermediate Range Ballistic Missile, was fired from the new proving ground by a Strategic Air Command (SAC) crew.¹

In May 1964, Headquarters Air Force Western Test Range (AFWTR) was activated at VAFB at the same time that Headquarters Air Force Missile Test Center at Patrick AFB was redesignated the Air Force Eastern Test Range (AFETR). Subsequent organizational changes were as follows:

- February 1965 - The AFWTR assumed operational control of the Pacific Missile Range from the Navy.
- May 1967 - Air Force Systems Command (AFSC) combined its Space and Missile Ballistic Systems into the Space and Missile Systems Organization (SAMSO).
- April 1970 - Headquarters Space and Missile Test Center (SAMTEC) was activated at VAFB with assignment to SAMSO. Headquarters Air Force Western Test Range (AFWTR) was inactivated and personnel were reassigned to SAMTEC. The title of Western Test Range was retained for the national missile range in the Pacific.
- February 1977 - SAMTEC assumed operational control of AFETR which was redesignated as Detachment 1, SAMTEC.
- October 1979 - Headquarters USAF directed realignment of SAMTEC into the Eastern Space and Missile Center (ESMC) at Patrick AFB and the Western Space and Missile Center (WSMC) at Vandenberg AFB - both reporting directly to the newly established Headquarters Space and Missile Test Organization (SAMTO) at VAFB. The old SAMSO organization became the Space Division of the Air Force Systems Command, the intermediate organization between the ranges and AFSC.

Through 09 February 1989, there has been a total of 1619 launches from the WTR. These include ballistic, orbital and other special tests. **Table 1₂** shows the number of launches conducted by various Range Users. Of this number, none resulted in injury to personnel or damage to property in the "public domain".

2. Organization - At the present time, the First Strategic Aerospace Division (1STRAD) of SAC is the host organization and is responsible for all missile ground safety at VAFB. Missile ground safety authority for all AFSC facilities and operations at VAFB is delegated to the WSMC Commander.³ Commercial operations are planned to be conducted at these same WSMC facilities.

The WSMC and SAMTO are tenant organizations on VAFB and are subordinate to the AFSC. SAMTO is the higher headquarters of both the Eastern Space and Missile Center (ESMC) and the WSMC which, in turn, is the parent organization of the WTR. The WTR is the organization responsible for providing support for all missile launch operations. See **Figure 1₄** for a block diagram of the WSMC organization.

3. Western Test Range - The WTR is a geographical area as well as an organization. It extends from VAFB to the west, encompasses the entire Pacific area and reaches to the middle of the Indian Ocean where it meets the Eastern Test Range (ETR) at 90 degrees East longitude. See **Figure 2₅** for a graphical representation of the WTR.

The WTR has Space Launch Complexes (SLC's), ordnance and propellant storage facilities, missile booster and spacecraft build-up areas, radar and optics tracking sites, telemetry, a WTR timing facility, a Range Operations and Control Center (ROCC), command destruct transmitter sites, extensive communications capabilities and other support facilities. The launch complexes and all hazardous operating and storage areas have been sited in accordance with DOD and Air Force explosive quantity distance siting criteria.

WSMC instrumentation facilities are augmented by support from the Air Force Flight Test Center, Edwards AFB, California, for inland cruise missiles and aircraft testing; the Pacific Missile Test Center (PMTTC), Point Mugu, California; the Pacific Missile Range Facility (PMRF), Kauai, Hawaii; the Advanced Research Projects Agency (ARPA) facility, Maui, Hawaii; and the United States Army Kwajalein Atoll (USAKA) missile range, Kwajalein Atoll, Marshall Islands. These sites are used for tracking missiles and space vehicles from launch to orbital insertion or ocean impact.

TABLE 1. WSMC MAJOR LAUNCH RECAP						
YEAR	AFSC	SAC	NASA	NAVY	OTHER*	TOTAL
1958	1	0	0	0	0	1
1959	8	1	0	12	10	31
1960	13	7	1	0	22	43
1961	29	2	2	0	7	40
1962	57	15	0	2	5	79
1963	63	45	1	5	2	116
1964	48	69	0	0	2	119
1965	51	50	0	0	0	101
1966	64	55	1	3	0	123
1967	63	38	4	5	3	113
1968	42	24	4	6	2	78
1969	42	34	2	16	1	95
1970	29	44	2	8	2	85
1971	28	43	2	8	3	84
1972	25	21	7	10	2	65
1973	24	13	3	3	1	44
1974	23	14	5	5	2	49
1975	22	14	5	5	1	47
1976	16	15	2	6	2	41
1977	12	12	1	6	1	32
1978	17	10	3	1	1	32
1979	13	11	1	1	1	27
1980	15	9	0	3	0	27
1981	10	8	3	0	0	21
1982	5	9	1	2	0	17
1983	16	9	3	0	0	28
1984	13	8	2	0	0	23
1985	9	6	1	0	1	17
1986	8	6	0	0	0	14
1987	7	4	2	0	0	13
1988	3	5	3	0	2	13
1989	0	1	0	0	0	1
TOTAL	776	602	61	107	73	1619

* Other includes: Air Defense Command, Arnold Engineering, Cambridge Research Lab, Royal Air Force and Tactical Air Command launches.

Note: Information is provided up to and including 09 February 1989.

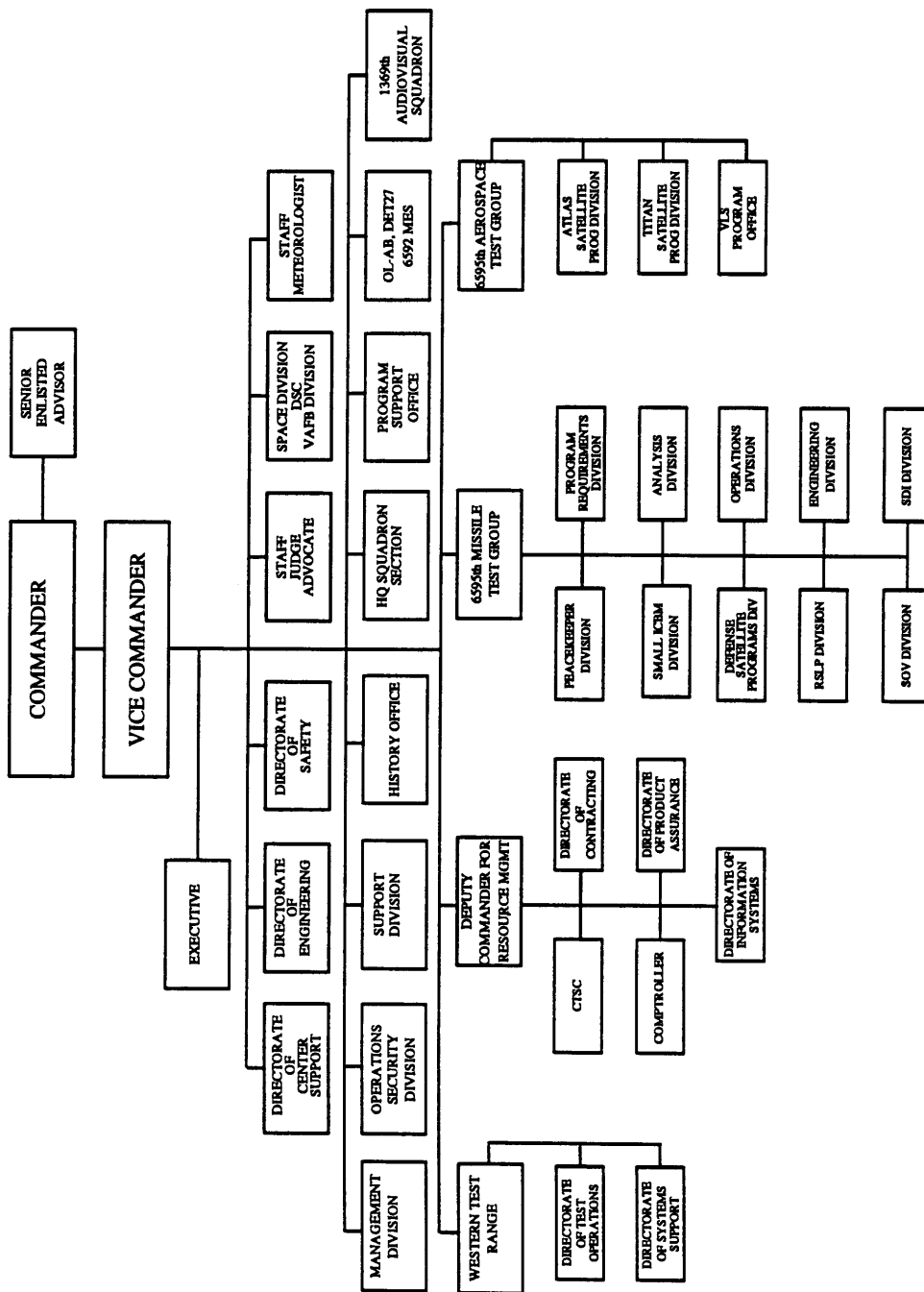


FIGURE 1. WESTERN SPACE AND MISSILE CENTER ORGANIZATION

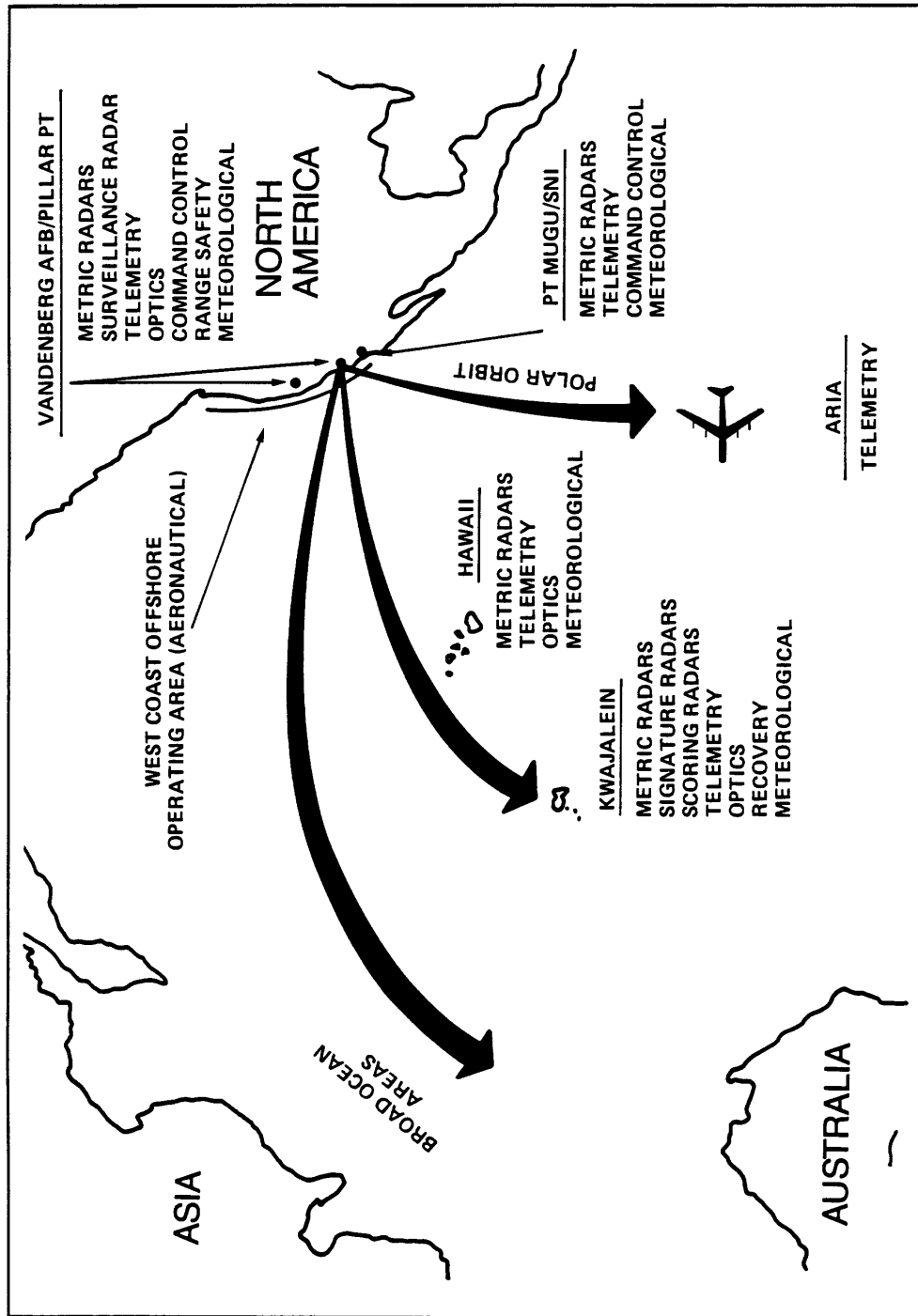


FIGURE 2. WESTERN TEST RANGE

The WTR is a service-oriented organization whose basic mission is to collect, process and deliver test-related data to Range Users. In supporting a typical test, the WTR collects metric, telemetric, photographic, acoustic and meteorologic data and, when requested, performs data processing, reduction and analysis to the User's specifications.

a. Complexes and Facilities - VAFB contains seven major launch complexes which support, or have supported, Minuteman, Peacekeeper, Delta, Atlas, Titan, Scout and Shuttle. See **Figure 3₆** for the locations of the various launch complexes. The most active complexes at this time are Minuteman, with launch operations from launch facilities 02, 03, 05, 06 and 08, the Atlas Space Launch Complex (SLC-3) and Titan (SLC-4). The Shuttle facility, designated SLC-6, has been placed in caretaker status and is not planned for use to support Shuttle launches in the foreseeable future. It has been approximately four years since a Delta vehicle has been launched from the WTR; however, one mission is currently being planned for FY 1989. All launch complexes are in remote areas and are arranged in a row adjacent to the beach. They were sited so that an accident on one pad would be unlikely to propagate to an adjoining complex or facility; however, for an in-flight vehicle, it should be noted that a launch complex or support facility will not survive a direct impact of an intact vehicle.

(1) Atlas Space Launch Complex (SLC-3) - This complex is used to launch the Atlas space vehicle and has two different pads which are designated as SLC-3E and SLC-3W. These complexes are located approximately 1750 feet apart. Atlas fuel (RP-1) and oxidizer (liquid oxygen) along with high pressure gas storage facilities are located at the complex. This launch facility is located approximately 2.4 miles from the VAFB boundary (see **Figure 3**) at the closest point and ~ 6 miles from the nearest city (Lompoc, California).⁴ **Figure 4₇** shows a layout of the Atlas launch complex.

(2) Delta Space Launch Complex (SLC-2) - The complex used to launch the Delta vehicle is comprised of two independent launch facilities designated SLC-2E and SLC-2W. These complexes are located approximately 2000 feet apart. The complex contains storage tanks for fuel and oxidizer on opposite sides of the launch pad to provide a safe environment in the event of an accident or spill. This launch facility is located approximately 8.4 miles from the nearest Vandenberg boundary and ~ 10.4 miles from the city of Lompoc, California (see **Figure 3**).⁴ **Figure 5₇** shows a layout of the Delta launch complex.

(3) Scout Space Launch Complex (SLC-5) - The complex used to launch the Scout vehicle has only one launch pad and is designated SLC-5. This launch facility is located approximately 5.8 miles from the closest Vandenberg boundary and ~ 8 miles from Lompoc, California (see **Figure 3**).⁴ See **Figure 6₇** for a layout of SLC-5.

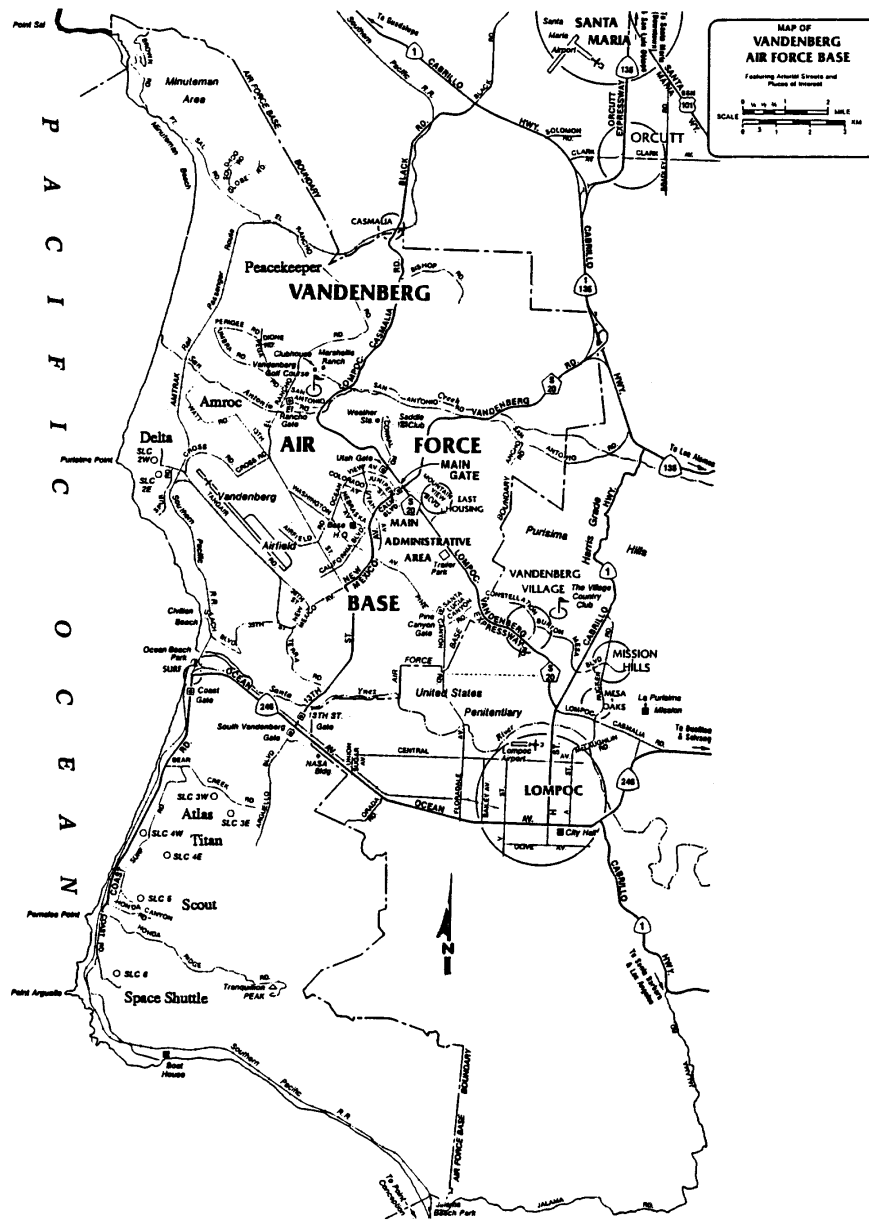
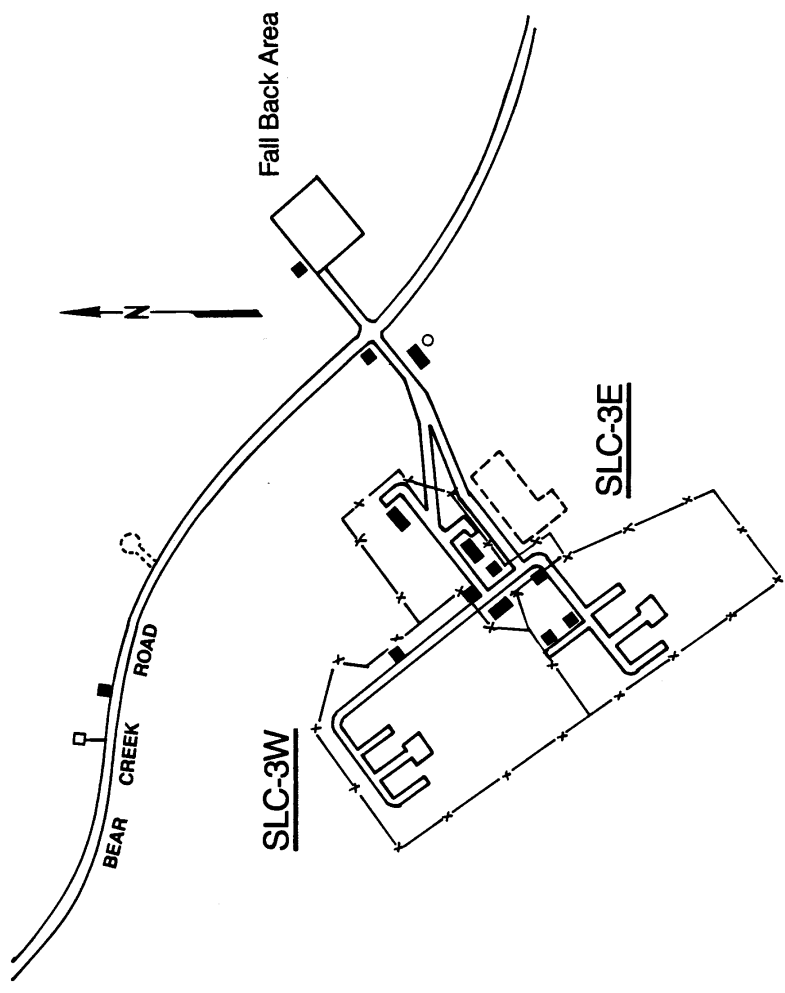


FIGURE 3. VANDENBERG AIR FORCE BASE



1 inch = 850 feet

FIGURE 4. ATLAS SPACE LAUNCH COMPLEX

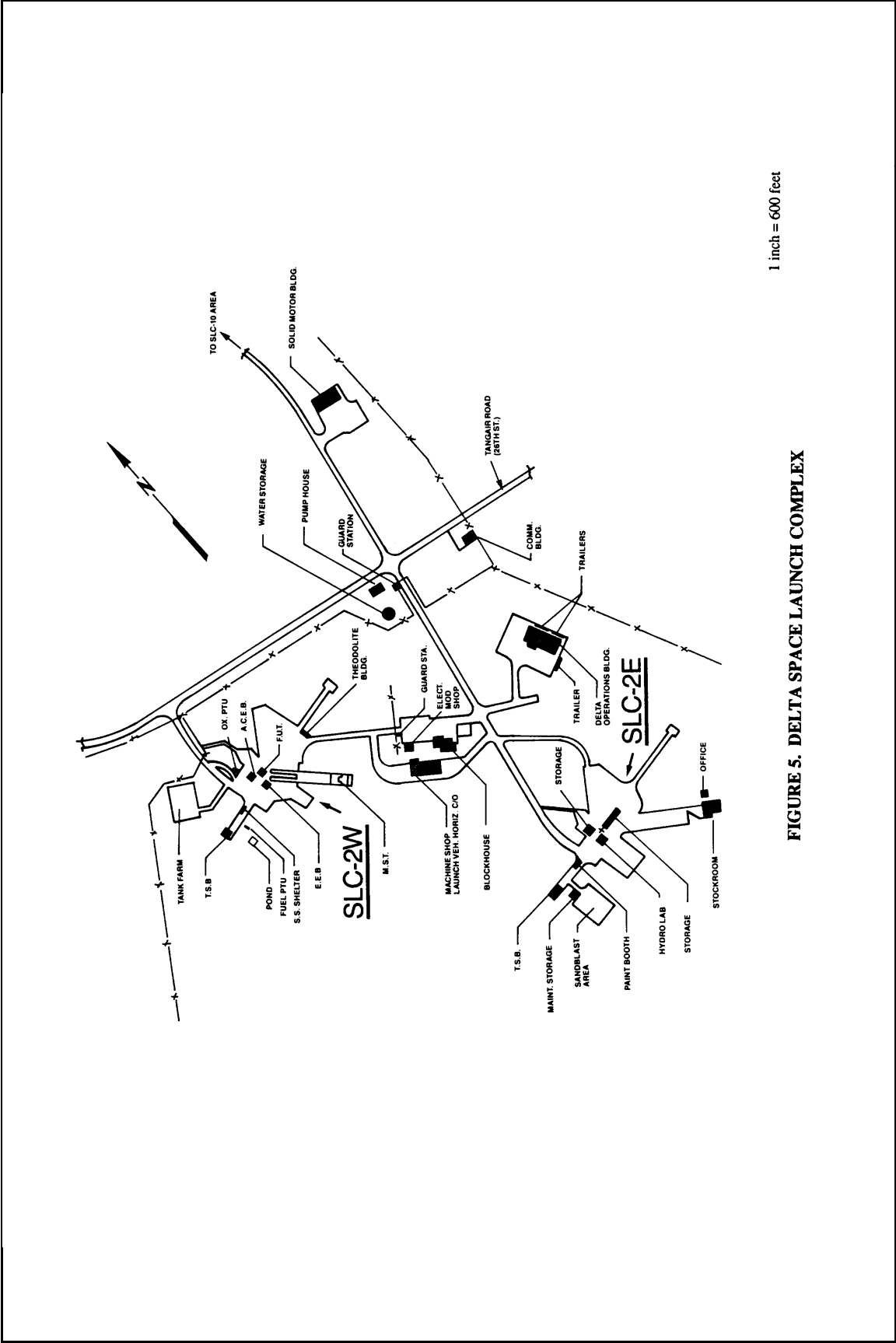


FIGURE 5. DELTA SPACE LAUNCH COMPLEX

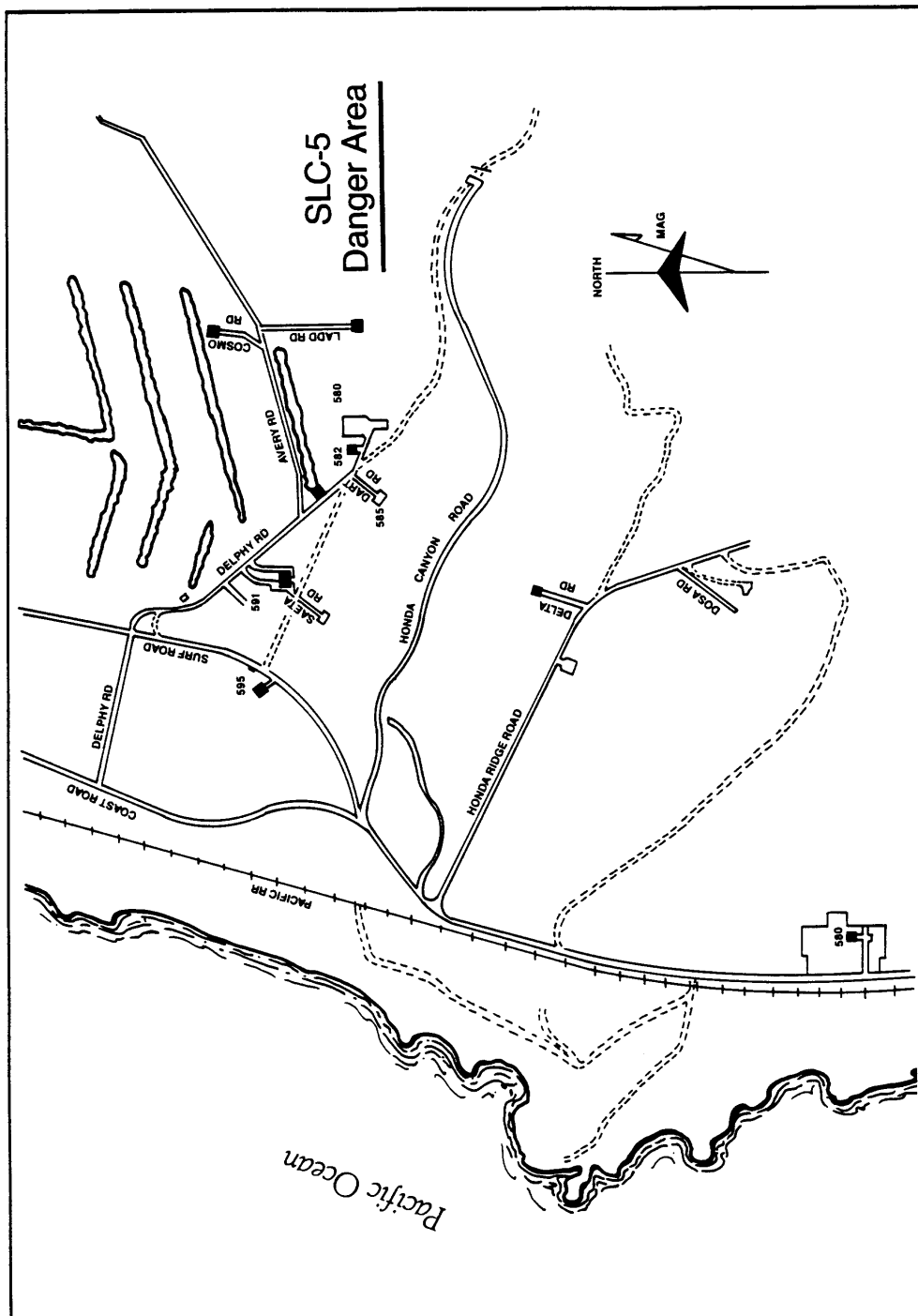
1 inch = 600 feet

(4) Titan Space Launch Complex (SLC-4) - The complex used to launch the Titan vehicle has two launch pads. One is designated SLC-4E and the other is SLC-4W. These complexes are approximately 3000 feet apart and are used exclusively by the Air Force to support Department of Defense missions. They are located approximately 5.2 miles from the nearest Vandenberg boundary and ~ 7.8 miles from the city of Lompoc, California (see **Figure 3**).⁴ See **Figure 7**,₇ for a layout of SLC-4.

(5) Other Launch Complexes - The AMROC launch complex is located in the northern portion of VAFB, northeast of the Delta complex and southwest of the peacekeeper launcher, see **Figure 3**. The pad was previously used to launch Atlas ABRES and has been refurbished and modified to accommodate the AMROC vehicle. Currently, plans exist to launch the American Rocket Company's (AMROC) commercial test vehicle during FY1989.

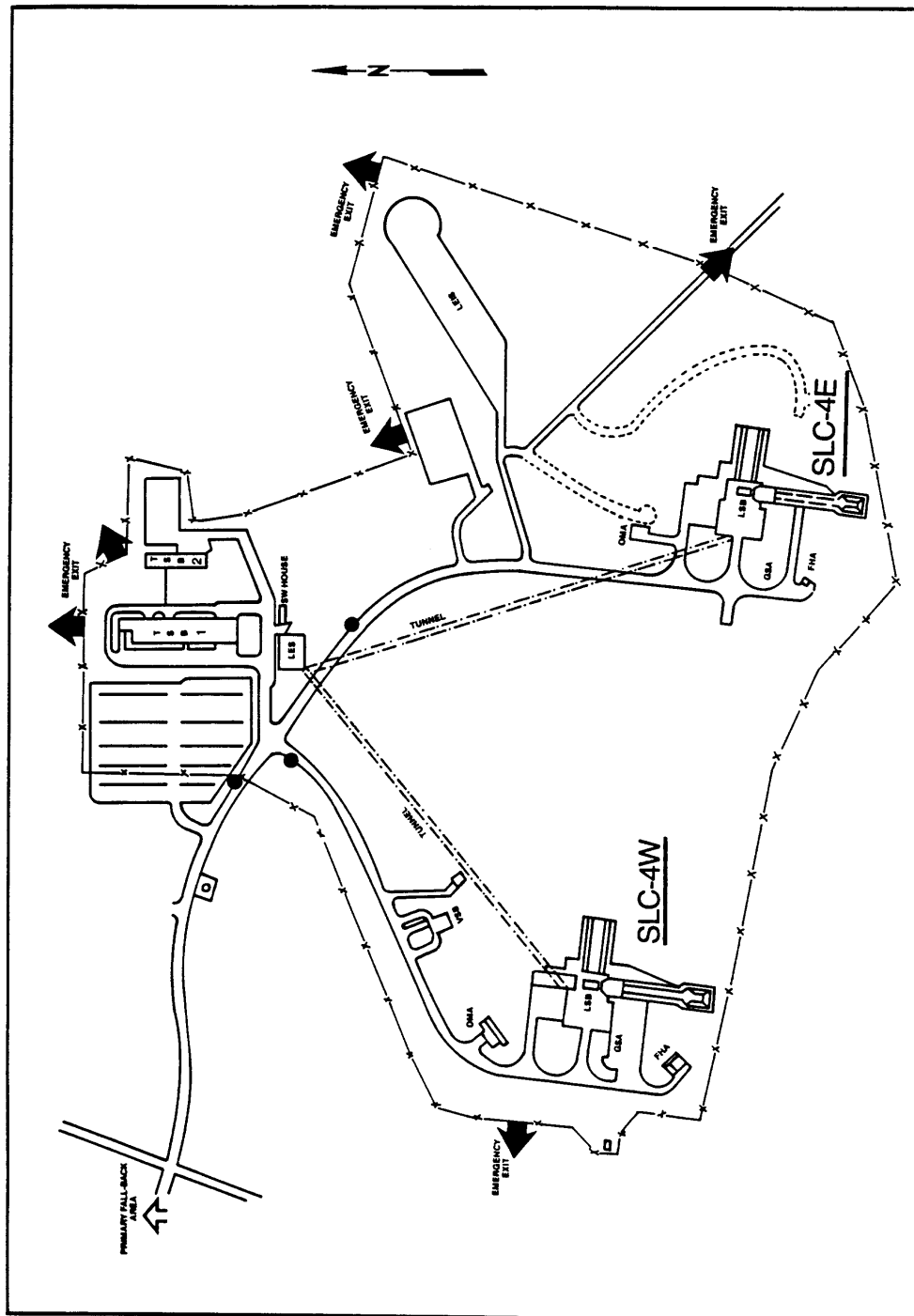
Also, in the planning stages, is the development of a new launch complex designated SLC-7. This multipurpose facility is envisioned to support the Titan IV vehicle as well as other vehicles that may come along in the future. The proposed location of the launch complex is on the southern end of VAFB, southeast of SLC-6 (Shuttle Complex). Refer again to **Figure 3**.

In addition to the launch complexes and booster vehicle storage and buildup areas, there are payload checkout areas where the various payloads are checked out, mated to payload boost motors and readied for transfer to the launch complex for mating to the launch vehicle. Payload boost motors normally are small solid rocket motors that are used to place spacecraft into final orbit. These motors are stored in an ordnance storage area and are delivered to the designated spacecraft checkout area and mated to the spacecraft as one of the last operations before the spacecraft is transferred to the pad. Some of the more recent, larger spacecraft use liquid propellant boost motors. In this case, the tanks are loaded on the pad, normally, during countdown preparations for launch.⁸



1 inch = 1000 feet

FIGURE 6. SCOUT SPACE LAUNCH COMPLEX



1 inch = 550 feet

FIGURE 7. TITAN SPACE LAUNCH COMPLEX

b. Local and Downrange Instrumentation Sites,

(1) Radars - In conjunction with other ranges, principally the Pacific Missile Test Range (NAVY), the Air Force Flight Test Center and the Kwajalein Missile Range (Army), the WTR gives continuous instrumentation coverage over a broad portion of the western United States and the Pacific Ocean. Precision radar tracking systems are situated at VAFB, Pillar Point AFS, San Nicolas Island (Navy), and Point Mugu (Navy), California, and Kaena Point, Hawaii. These radar systems provide trajectory data for range safety, flight analysis, aircraft vectoring and weather balloon tracking. A variety of reduced metric data products is available.

The WSMC operated FPQ-14 radar at Kaena Point, Hawaii, has been modified with a directed tracking modification (DTM). The DTM reduces errors and allows extremely accurate midcourse tracking of missiles launched from VAFB. The Advanced Research Projects Agency (ARPA) Maui Observation Station (AMOS), Mt. Haleakala, Maui, Hawaii, an optical site with long-range sensitive optics, is available along with the telemetry and radar systems.

(2) Flight Termination/Command Control - Five Command Control Transmitter sites are used by the Range Safety Officer to transmit flight termination commands to an errant or malfunctioning vehicle. These sites are designated CT-1,2,3,4 and 6. CT sites 1,2 and 3 are located at VAFB, CT-4 is located at Pillar Point AFS and CT-6 is located at the USN Pacific Missile Test Center, Laguna Peak.

(3) Telemetry - Receiving and recording stations at VAFB's Telemetry Receiving Site (Oak Mountain) facility and Pillar Point AFS, with their associated antennas, acquire, record and transmit telemetry data to the VAFB data centers. The data centers are capable of providing real-time computation, quick-look displays and computer listings.

(4) Communications - The communications network in use at the WTR is comprised of voice, teletype, secure voice, central office, satcom, subcable, microwave, radio, datacom, navigational aids and closed circuit television. These communication systems are used, not only to support launch operations and range safety, but also the day to day activities at Vandenberg AFB and other landbased and downrange stations.

(5) Optics - Three large-aperture optical instruments are situated on coastal mountains: one on VAFB, one 150 miles north (Anderson Peak) and one 30 miles southeast (Santa Ynez Peak). They are equipped with both film cameras and intensified video systems for recording ballistic missile launch data and space test events.